

Community-based selection indicators in Borgou cattle farming systems in north Benin

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Owning the best productive animals is among of the production goals of cattle farmers. This study aimed at exploring the selection indicators used by farmers to identify best promising cattle. Data were collected through surveys from 105 cattle farmers identified as Borgou cattle farmers. The data collected enabled to determine the scores and indices of each criterion mentioned according to the performance sought by the farmers. In general, farmers mentioned several indicators (≥ 5) for each performance sought and considered that the first three of each list were the best. The results showed that for the selection of animals for the improvement of dairy performance, farmers considered long teat (index=0.28; rank=1), the presence of veins in the udder (index=0.18; rank=2) and well-shaped udder (index=0.17; rank=3) as the three main best of the nine indicators mentioned. For meat production, the best selection indicators mentioned were thoracic development (index=0.23), body length (index=0.19), and straight legs (index=0.17) among the seven indicators mentioned. For selecting breeding males, five major indicators were mentioned and indicators such as large scrotum, long tail, and large hump were ranked as the top (index=0.31; 0.22 and 0.19 respectively). As for the selection of breeding females, farmers mentioned the presence of large rump much more (rank=1); docility (rank=2), and straight legs of the animal (rank=3). This study enables to take into account cattle farmers' knowledge for designing community-based conservation of the Borgou cattle in its native range.

Keywords: Knowledge, communities, selection, performance, cattle, Benin

INTRODUCTION

Thousands of genetically diverse breeds of domestic animals adapted to a wide range of environmental conditions and human needs have resulted from human and natural selection. The main performances sought by cattle farmers in traditional systems are generally about meat, milk, and reproduction. In indigenous African cattle production systems, herd performance generally remains low due to lack of feed, health, or environmental constraints (Wilson, 2018). These factors have also become causes for the abandonment of certain cattle breeds in favor of others deemed more efficient, thus causing serious risks of loss of biodiversity in many countries. In this regard, the issue of the conservation of breeds deemed less efficient is essential and requires the effective involvement of the local communities who own

them (Tesfa *et al.*, 2017; Traoré *et al.*, 2017; Skjerve *et al.*, 2018). To reduce the effects of these factors, cattle farmers find themselves in the need to make decisions that guide the choice of breeds (Roessler, 2019; Soeharsono *et al.*, 2020; Yakubu *et al.*, 2020; Zoma-Traoré *et al.*, 2021). It is therefore obvious that each cattle farmer bases himself on particular criteria or signs observable on the animals which allow him to attribute a performance potential for such or such performance (Banerjee *et al.*, 2014; Adamou Karimou *et al.*, 2017; Bulcha, 2022). In Benin, in terms of conservation of the Borgou cattle breed, government efforts focus on maintaining only a few nuclei of that breed on station farms. However, herding communities are the main owners of that breed in rural areas. It is therefore judicious that the efforts and knowledge of these communities be used to guarantee the sustainable in-situ conservation of that breed. For this reason,

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a series of studies have been carried out with the aim of promoting the in-situ conservation of the Borgou cattle breed in its native range insofar as it is continuously outcrossed with Zebu breeds (Worogo *et al.*, 2020, 2022a, 2022b). Thus, the present study fits into the dynamics of exploring and elucidating the selection criteria used by cattle farmers for choosing the best promising animals within their herds.

MATERIALS AND METHODS

Data collection: This study occurred from June to August 2020 and involved 105 cattle farmers distributed in the municipalities of Tchaourou, Pèrèrè, Nikki, Kalalé, and Parakou in northern Benin. These farmers were those who participated in the same study areas in the previous phases of the project aiming at the in-situ conservation of the Borgou cattle breed in its native range (Worogo *et al.*, 2020, 2022a, 2022b) and who gave their agreement for the continuation of the data collection. In fact, these farmers were mainly made up of three ethnic groups (Gando, Fulani, and Bariba). Fulani and Gando raise Borgou cattle for milk and meat purposes while the Bariba raise that breed for crop farming (draught). They were all Muslims and very few of them received a formal education. The heads of the farms were around 40 years of age with a household size ranging from 2 to 32 people. These cattle farmers generally combine cattle production with crop farming (Worogo *et al.*, 2020).

Data were collected through a semi structured questionnaire aimed at collecting information from the farmers community on the criteria for selecting animals for the improvement of dairy, meat and reproductive performance. Each cattle farmer was asked to mention, in order of importance, the best indicators considered according to each type of performance.

Data analysis: For criteria related to morphometric indicators of meat, dairy, and reproduction, performance, scores and indices were calculated and then ranked. For each selection indicator, the number of times a body trait is mentioned as the first indicator is multiplied by the coefficient of the last rank; the number of times a body trait is mentioned as the second indicator is multiplied by the coefficient of the penultimate

rank and so on until the number of times a body trait is mentioned as the last indicator is multiplied by the coefficient of the first rank. Finally, the value (sum) obtained for each selection indicator are therefore the score for that indicator. Then this score was divided by the sum of all scores to obtain the index value of each indicator (Tesfa *et al.*, 2017; Roessler, 2019; Bulcha, 2022). Then, these indices were sorted in descending order to obtain the rank of each indicator mentioned by the farmers. The software R Core Team (2021) was used for data analysis.

RESULTS

Cattle farmers' selection indicators for milk production: The criteria listed by farmers for the selection of cows capable to produce more milk are presented in Table 1. In total, 9 criteria were mentioned and distributed over 5 ranks. The presence of long teats in the cow was considered as the first criterion to take into account for the selection of cows (score=379; index=0.28). Cattle farmers expressed that a cow with long teats predisposes the cows to better support the suckling of the calf and therefore facilitates milking for the herdsman. The second biggest criterion is the marked presence of veins in the udder of the cow. For farmers, this characteristic means that cows are predisposed to a longer lactation duration than cows with fewer visible veins in the udder. The cattle farmers also mentioned well-shaped udder as an important criterion for milk production. This criterion orients to the possibility of obtaining a larger volume of milk during milking. The choice of cows with a smaller head was the fourth criterion mentioned by farmers (score=178; index=0.13). They also considered that cows with greater height at the withers can be good candidates for selection for milk production (5th criterion). Other criteria less mentioned as important but taken into account in the selection processes by farmers were the presence of a short tail, docility, the presence of thin skin, and a longer pelvis.

Cattle farmers' selection indicators for meat: The criteria listed by cattle farmers for the selection of young cattle capable of producing more meat are presented in Table 2. In

Table 1. Indicators listed by cattle farmers for selecting animals for milk production.

Indicator	NCR1	NCR2	NCR3	NCR4	NCR5	Score	Index	Rank
Long teat	38	32	13	11	0	379	0.28	1
Udder veins	13	27	13	11	6	240	0.18	2
well-shaped udder	21	21	7	7	0	224	0.17	3
Small head	7	18	12	13	9	178	0.13	4
Height at withers	0	0	20	16	14	106	0.08	5
Short tail	0	0	17	4	30	89	0.07	6
Docility	0	0	11	9	10	61	0.05	7
Thin skin	0	0	0	12	14	38	0.03	8
Rump length	0	0	0	7	15	29	0.02	9

NCR1...NCR5: Number of Counts in Rank



Table 2. Indicators listed by cattle farmers for selecting animals for meat production.

Indicator	NCR1	NCR2	NCR3	NCR4	NCR5	Score	Index	Rank
Developped chest	33	23	17	11	2	332	0.23	1
Long body	21	19	22	5	11	268	0.19	2
Straight legs	14	18	16	23	6	242	0.17	3
Balanced body	17	19	9	16	5	225	0.16	4
Good height	8	14	13	20	11	186	0.13	5
Strong withers	0	6	13	29	24	145	0.10	6
Large canon	0	0	0	11	6	28	0.02	7

NCR1...NCR5: Number of Counts in Rank

Table 3. Indicators listed by cattle farmers for selecting males and females for reproduction.

Indicator in heifers	NCR1	NCR2	NCR3	NCR4	NCR5	Scores	Index	Rank
Large Rump	23	25	17	14	7	301	0.240	1
Docility	20	24	11	27	13	296	0.239	2
Straight legs	17	19	26	18	12	287	0.232	3
Large pelvis	11	17	16	12	7	202	0.160	4
Good withers height	0	7	10	9	7	83	0.070	5
Long tail	0	0	9	11	21	70	0.060	6
Indicator in reproductive bulls	NCR1	NCR2	NCR3	NCR4	Scores	Index	Rank	
Large scrotum	44	36	27	20	358	0.31	1	
Long tail	32	28	17	9	255	0.22	2	
Huge hump	30	14	23	16	224	0.19	3	
Long penis	15	24	13	16	174	0.15	4	
Good temperament	11	19	23	14	161	0.14	5	

NCR1...NCR5: Number of Counts in Rank

total, 7 criteria were mentioned and distributed over 5 ranks. The most striking indicator was the presence of good thoracic development in the animals (score=332; index=0.23). Selecting an animal with a long body was the second most important criterion put forward by farmers. For farmers, animals with straight legs can be used to boost meat performance (rank 3). Choosing an animal with a balanced body constitution and then a good size were, respectively, the 4th and 5th criteria for meat production. The last two criteria listed were the presence of strong withers (score=145; index=0.1), and then the presence of a large canon (score=28; index=0.02).

Cattle farmers' selection indicators for reproduction:

Table 3 provide information on the criteria listed by farmers for the selection of males and females for reproduction. For the selection of breeding heifers, 6 main indicators spread over 5 ranks have been put forward by farmers. They considered that they primarily took into account heifers with larger rump (score=301; index=0.24) then secondarily the docility of the animal (score=296; index=0.239). The third major criterion, according to the farmers, was the presence of the straight legs in heifers. Taking into account animals with a wide pelvis and an accentuated height at the withers were not less important criteria for these farmers (rank 4 and 5 respectively). Farmers also expressed the possibility to find

good future female breeders when considering a female with longer tails (score=70; index=0.06).

As for males, 5 selection criteria spread over 4 ranks were mentioned by farmers to select the best bulls. In fact, the large scrotum is considered an excellent index for selection (score=358; index=0.31). Long-tailed males were also designated as good future breeders (index=0.22; rank=2). The third criterion was the presence of large hump. According to the farmers, males with a long penis are also good candidates for breeding (score=224, rank=4). The selection criterion that presented the lowest index was the observation of good temperament in the animals (index=0.14).

DISCUSSION

Indigenous knowledge of cattle farmers is essential for improving production systems while safeguarding biodiversity. This study revealed that the technical considerations in terms of cattle selection are diversified depending on the performance sought in the animals. In fact, although several indicators were mentioned by farmers, they considered that the first three criteria listed for each desired performance are generally the best ones to give priority to. This remark was also mentioned by [Bulcha et al. \(2022\)](#) in dairy farmers in Ethiopia.



In the present study, the top three main criteria cited by farmers were long teat, udder veins and well-shaped udder. In southern Ethiopia, [Banerjee et al. \(2014\)](#) reported that these criteria were the most frequently cited by various indigenous communities. These first criteria constitute measurements linked to the morphology of the udder of cows. In fact, several studies showed that udder dimensions are much more positively correlated with milk production compared to other body measurements ([Martin-Collado et al., 2015](#); [Mammo et al., 2017](#)). Our study revealed that cows with small heads were more suitable for milk production according to breeders. Similar to our study, this criterion was listed as an important indicator for obtaining good lactation in females by cattle farmers in Ethiopia. ([Banerjee et al., 2014](#)). Other authors ([Adamou Karimou et al., 2017](#)) also reported that criteria such as teat length, tail length, rump length are criteria mentioned by cattle farmers of Kouri cattle in Niger. Similar to our study, height at the withers was considered a good indicator for selecting milking cows ([Adamou Karimou et al., 2017](#); [Bulcha et al., 2022](#)).

In the present study, a long body is considered as a precursor to the ability to produce more meat. Farmers interviewed in our study mentioned good thoracic development and the presence of a long body as the very first criteria to consider when selecting cattle for meat production. Compared to the indigenous communities surveyed by [Banerjee et al. \(2014\)](#) in southern of Ethiopia, the farmers prefer to favor straight backbone and legs as the two best criteria. However, the breeders surveyed by these authors also mentioned long body and muscularity as other criteria in the selection of meat animals. From another point of view, in the reports of [Banerjee et al. \(2014\)](#), bulls with long body were considered to have a good libido. In addition, for some cattlemen in Ethiopia, body length is considered as an indicator rather related to milk production ([Bulcha et al., 2022](#)). In this study, cattle farmers mentioned that they consider animals with a large canon to be suitable candidates for meat production. Moreover, among Kouri cattle breeders in Niger, this criterion is considered an important indicator for predicting milk potential in cows ([Adamou Karimou et al., 2017](#)). This demonstrates that farmers' beliefs about animal selection vary from one environment to another.

Good reproductive performance in both males and females is essential for profitable production for cattlemen ([Berry et al., 2014](#); [Buzanskas et al., 2017](#)). In the present study, five main selection criteria were listed by farmers for the selection of future breeding males. In order of importance, these criteria were the presence of a large scrotum, long tail, a large hump, long penis and a good temperament. Similar results were reported by some authors in other countries. In fact, the presence of a large scrotum and a long penis are generally considered good indicators of fertility and an advantage in performing mating more efficiently in males ([Banerjee et al., 2014](#); [Bulcha, 2022](#)). In fact, the fertility of males is

considered as a decisive factor for the evolution and performance of the herd and can be privileged at the individual level in the bull than in the cow ([Kastelic, 2013](#); [Akpo et al., 2018](#); [Dotche et al., 2019](#)). In this study, the choice of long-tailed males is considered by farmers to be an important factor in obtaining healthy offspring. This consideration is similar to that mentioned by some authors who reported that a long tail is generally associated with the ability of an animal to get rid of certain external parasites and therefore better health ([Banerjee et al., 2014](#)). In this study, good temperament was also mentioned as a selection indicator. In fact, cattle farmers consider that this criterion makes breeding management easier; i.e., animals with a good temperament are less feisty and are apt to have a good libido. On the other hand, according to the considerations of the farmers interviewed by [Banerjee et al. \(2014\)](#) in southern Ethiopia, libido is closely associated with body length in male and cattle.

Conclusion: This study enabled to explore the body indicators on which the farmers involved in the rearing of Borgou cattle breed base themselves for the selection of their animals. These indicators are different depending on the performance sought in the animals and are considered at different levels of importance. In fact, there is a need to take into consideration the animal selection practices of farmers with the view to promote better herd management as well as the conservation of animal biodiversity in traditional production systems. With this, this study constitutes a step forward for the implementation of a sustainable in-situ conservation program for the Borgou cattle breed in its native range.

Authors contribution: HSSW participated in project design, directed data collection, analysed data, drafted, and wrote the manuscript. TOLFO, YI, ASA and NB were involved in project design, data analysis and revised the manuscript. CDA, JSA, MA, JSBSW and BGCA participated in data collection, data analysis and revised the manuscript. ITA was involved in the project design, data analysis and revised this manuscript.

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